Report Element Changes Proposed for DO-242A

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- Why change the report elements?
- What are the changes?

Why Change the Report Structures?

- Include NIC/NAC/SIL changes
- Clarify data element definitions
- Clarify data rate requirements: report elements that have similar update requirements should be grouped in the same report.
- Clarify data requirements by equipage class
- Address ambiguities experienced by MOPS users
- Improve readability of the requirements

Problems With Current State Vector (SV) Report

- The current definition of the SV report (in DO-242 section 3.4.3.1) includes elements that are not really required to be transmitted by all participants, all the time.
- Some SV elements change less frequently than the main elements (position and velocity) change – but the MASPS requirements on update rate apply to all SV elements.

Changes to the SV Report

- Move airspeed from the SV report to an On Condition report, because unlike other SV elements, airspeed is not intended to be reported for all ADS-B participants.
- Indicate which SV elements are to be reported for airborne participants, and which are to be reported for surface participants.

Changes to the SV Report

- Add elements to indicate the validity/availability of other elements: horizontal position valid, geometric altitude valid, vertical rate valid, etc.
- Place elements with low typical update rates (NAC, SIL) in the MS rather than the SV report.

Changes to the SV Report

- Indicate the resolution required, or the number of bits required, for each SV report element.
- For participants on the surface, report heading and ground speed (rather than track angle and ground speed).
- Report only one vertical rate and give the vertical rate type in the MS report.

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Table 3.4.3.1: State Vector Report Definition.

	SV Elem. #	Contents	[Resolution or # of bits]	Required from surface participants	Required from airborne participants	Reference Section	Notes
ID	1	Participant Address	[24 bits]	•	•	2.1.2.3.1	
	2	Address Qualifier	[1 bit]	•	•	2.1.2.3.2	[1]
TOA	3	Time Of Applicability	[0.2 s]	•	•	2.1.2.1	
Geometric Position	4a	Latitude (WGS-84)	[0.1 minutes of arc]	•	•	2.1.2.9	
	4b	Longitude (WGS-84)	[0.1 minutes of arc]	•	•		
	4c	Horizontal Position Valid	[1 bit]	•	•		
	5a	Geometric Altitude	[TBD]	•		2.1.2.6.2	
	5b	Geometric Altitude Valid	[1 bit]	•			
Horizontal Velocity	6a	North Velocity while airborne	[1 knot or 4 knot]	•		2.1.2.7.1	
	6b	East Velocity while airborne	[1 knot or 4 knot]	•			
	6c	Airborne Horizontal Velocity Valid	[1 bit]	•			
	7a	Ground Speed while on the surface	[TBD]		•	2.1.2.7.1	
	7b	Surface Ground Speed Valid	[1 bit]		•		
Heading	8a	Heading while on the Surface	[8 bits]		•	2.1.2.8	
	8b	Heading Valid	[1 bit]		•		
Baro Altitude	9a	Barometric Pressure Altitude	[25 ft or 100 ft]	•		2.1.2.6.2	
	9b	Pressure Altitude Valid	[1 bit]	•			
Vertical Rate	10a	Vertical Rate (Baro/Geo)	[TBD]	•		2.1.2.7.2	
	10b	Vertical Rate Valid	[1 bit]	•			
NIC	11	Navigation Integrity Category	[4 bits]	•	•	2.1.2.11	
Report Mode	12	Report Mode	[3 bits]			3.4.3.1.5	

Problems With MS Report

- Some MS elements (the TCP elements) are not required for all participants. Rather than describe “full” and “partial” MS reports (MS and MS-P reports), we thought it better to classify the TCP elements as parts of other reports than the MS report. [Reason: the update rate requirements for TCPs are quite different than those for the MS elements.]

Changes to MS Report

- Move TCP elements to “TCR+0” trajectory change report.
- Let capability class (CC) codes report capabilities of the avionics on board the transmitting aircraft rather than specific client applications. As each CC bit is allocated, define in the MASPS what it means, exactly, when that bit is set.

Changes to MS Report

- Specify the required resolution or required number of bits for each MS report element.
- Add aircraft size code (a 4-bit field) for reports on surface participants.
- Add NAC_P, NAC_V, and SIL elements to describe the accuracy and integrity level for position and velocity elements in the SV report.
- Add a “Barometric Altitude Integrity” code to describe the reliability of barometric pressure altitude.

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Table 3.4.3.2: Mode-Status (MS) Report Definition.

	MS Elem. #	Contents [Resolution or # of bits]	Reference Section	Notes
ID	1	Participant Address [24 bits]	2.1.2.3.1	
	2	Address Qualifier [1 bit]	2.1.2.3.2	[1]
TOA	3	Time of Applicability [1 s resolution]	2.1.2.1	
ID	4	Call sign [up to 8 alpha-numeric characters]	2.1.2.2	
	4	Participant Category [5 bits]	2.1.2.4	
	6	Aircraft Size Code [4 bits]	2.1.2.5	[2]
Status	7	Surveillance Support Code [1 bit]		[3]
	8	Emergency/Priority Status [3 bits]	2.1.2.17	
CC	9	Capability Class Codes [TBD bits]	2.1.2.9	
		9a: CDTI display capability [1 bit]	2.1.2.9.1	
		9b: TCAS enabled [1 bit]	2.1.2.9.2	
		9c: Service Level [3 bits]	2.1.2.9.3	
		(Reserved for future growth) [TBD bits]		
OM	10	Operational Mode Parameters [TBD bits]	2.1.2.10	
		10a: ACAS/TCAS resolution advisory active [1 bit]	2.1.2.10.1	
		10b: Transmitting Aircraft Size Code [1 bit]	1.1.1.1.1	
		10c: TCR Cycle # [2 bits]	2.1.2.10.2	
		10d: TCR+1 transition flag [1 bit]	2.1.2.10.3	
		(Reserved for future growth) [TBD bits]		
SV Integrity and Accuracy	11	Nav. Acc. Category for Position (NAC_P) [4 bits]	2.1.2.12	
	12	Nav Acc. Category for Velocity (NAC_V) [2 bits]	2.1.2.13	
	13	Surveillance Integrity Level (SIL) [2 bits]	2.1.2.14	
	14	Baro Altitude Integrity Codes [2 bits]	1.1.1.1	
		14a:		
		14b:		
Data Reference	15	True/Magnetic Heading [1 bit]		
	16	IAS/TAS/Mach Airspeed [2 bits]		
	17	Primary Vertical Rate Type (Baro/Geo.) [1 bit]		
Other	18	Flight Mode Specific Data [TBD bits]		[4]

New OC-ARV Report

(On Condition – Air Referenced Velocity)

- Includes airspeed and heading
- Not required about all participants all the time, so these elements were removed from the SV report
- The conditions for a participant to transmit the elements of the OC-ARV report are to be specified in the MASPS.

DO-242A OC-ARV Report

Table 3.4.3.4: Air Referenced Velocity (ARV) Report Definition.

	ARV Elem. #	Contents	[Resolution or # of bits]	Reference Section
ID	1	Participant Address	[24 bits]	2.1.2.3.1
	2	Address Qualifier	[1 bit]	2.1.2.3.2
TOA	3	Time of Applicability	[1 s resolution]	2.1.2.1
Airspeed	4a	Airspeed	[1 knot or 4 knots]	
	4b	Airspeed Valid	[1 bit]	
Heading	5a	Heading while airborne [Note 1]	[1 degree]	2.1.2.8
	5b	Heading Valid	[1 bit]	

New On Condition - Target State Report (OC - TSR)

- Short term intent – see presentation by Tony Warren and Richard Barhydt.
- TSR reports expected about participants of equipage class A1 and higher

On Condition - Trajectory Change Reports (OC - TCRs)

- Replace the TCP+0 and TCP+1 reports from the initial (DO-242) version of the ADS-B MASPS.
- TCR+0 reports would be provided only about participants of equipage class A2 and higher.
- TCR+1, TCR+2, TCR+3 only provided about participants of class A3.
- See separate presentation by Tony Warren and Richard Barhydt.

Conclusion

- WG-6 recommends that these changes be incorporated in the various data link MOPS being developed by WG-3 and WG-5.
- This is a step toward achieving the near-term Safe Flight 21 operational objectives.
- Therefore, it is appropriate to include these changes in current MOPS development activities.
- Godspeed and good luck!